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<110> Nam, Jae-Hwan  
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Emerson, Suzanne  
Purcell, Robert

<120> HCV/BVDV Chimeric Genomes and Uses Thereof

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Cys Pro Leu Trp Val Thr Ser Cys Ser Thr Asn Pro Lys Pro Gln Arg  
 165 170 175

Lys Thr Lys Arg Asn Thr Asn Arg Arg Pro Gln Asp Val Lys Phe Pro  
 180 185 190

Gly Gly Gly Gln Ile Val Gly Gly Val Tyr Leu Leu Pro Arg Arg Gly  
 195 200 205

Pro Arg Leu Gly Val Arg Ala Thr Arg Lys Thr Ser Glu Arg Ser Gln  
 210 215 220

Pro Arg Gly Arg Arg Gln Pro Ile Pro Lys Ala Arg Arg Pro Glu Gly  
 225 230 235 240

Arg Thr Trp Ala Gln Pro Gly Tyr Pro Trp Pro Leu Tyr Gly Asn Glu  
 245 250 255

Gly Cys Gly Trp Ala Gly Trp Leu Leu Ser Pro Arg Gly Ser Arg Pro  
 260 265 270

Ser Trp Gly Pro Thr Asp Pro Arg Arg Arg Ser Arg Asn Leu Gly Lys  
 275 280 285

Val Ile Asp Thr Leu Thr Cys Gly Phe Ala Asp Leu Met Gly Tyr Ile  
 290 295 300

Pro Leu Val Gly Ala Pro Leu Gly Gly Ala Ala Arg Ala Leu Ala His  
 305 310 315 320

Gly Val Arg Val Leu Glu Asp Gly Val Asn Tyr Ala Thr Gly Asn Leu  
 325 330 335

Pro Gly Cys Ser Phe Ser Ile Phe Leu Leu Ala Leu Leu Ser Cys Leu  
 340 345 350

Thr Val Pro Ala Ser Ala Tyr Gln Val Arg Asn Ser Ser Gly Leu Tyr  
 355 360 365

His Val Thr Asn Asp Cys Pro Asn Ser Ser Ile Val Tyr Glu Ala Ala  
 370 375 380

Asp Ala Ile Leu His Thr Pro Gly Cys Val Pro Cys Val Arg Glu Gly  
 385 390 395 400

Asn Ala Ser Arg Cys Trp Val Ala Val Thr Pro Thr Val Ala Thr Arg  
 405 410 415

Asp Gly Lys Leu Pro Thr Thr Gln Leu Arg Arg His Ile Asp Leu Leu  
 420 425 430

Val Gly Ser Ala Thr Leu Cys Ser Ala Leu Tyr Val Gly Asp Leu Cys  
 435 440 445

Gly Ser Val Phe Leu Val Gly Gln Leu Phe Thr Phe Ser Pro Arg Arg  
 450 455 460

His Trp Thr Thr Gln Asp Cys Asn Cys Ser Ile Tyr Pro Gly His Ile  
 465 470 475 480

Thr Gly His Arg Met Ala Trp Asp Met Met Met Asn Trp Ser Pro Thr  
 485 490 495

Ala Ala Leu Val Val Ala Gln Leu Leu Arg Ile Pro Gln Ala Ile Met  
 500 505 510

Asp Met Ile Ala Gly Ala His Trp Gly Val Leu Ala Gly Ile Ala Tyr  
 515 520 525

Phe Ser Met Val Gly Asn Trp Ala Lys Val Leu Val Val Leu Leu Leu  
530 535 540

Phe Ala Gly Val Asp Ala Glu Thr His Val Thr Gly Gly Asn Ala Gly  
545 550 555 560

Arg Thr Thr Ala Gly Leu Val Gly Leu Leu Thr Pro Gly Ala Lys Gln  
565 570 575

Asn Ile Gln Leu Ile Asn Thr Asn Gly Ser Trp His Ile Asn Ser Thr  
580 585 590

Ala Leu Asn Cys Asn Glu Ser Leu Asn Thr Gly Trp Leu Ala Gly Leu  
595 600 605

Phe Tyr Gln His Lys Phe Asn Ser Ser Gly Cys Pro Glu Arg Leu Ala  
610 615 620

Ser Cys Arg Arg Leu Thr Asp Phe Ala Gln Gly Trp Gly Pro Ile Ser  
625 630 635 640

Tyr Ala Asn Gly Ser Gly Leu Asp Glu Arg Pro Tyr Cys Trp His Tyr  
645 650 655

Pro Pro Arg Pro Cys Gly Ile Val Pro Ala Lys Ser Val Cys Gly Pro  
660 665 670

Val Tyr Cys Phe Thr Pro Ser Pro Val Val Val Gly Thr Thr Asp Arg  
675 680 685

Ser Gly Ala Pro Thr Tyr Ser Trp Gly Ala Asn Asp Thr Asp Val Phe  
690 695 700

Val Leu Asn Asn Thr Arg Pro Pro Leu Gly Asn Trp Phe Gly Cys Thr  
705 710 715 720

Trp Met Asn Ser Thr Gly Phe Thr Lys Val Cys Gly Ala Pro Pro Cys  
725 730 735

Val Ile Gly Gly Val Gly Asn Asn Thr Leu Leu Cys Pro Thr Asp Cys  
740 745 750

Phe Arg Lys His Pro Glu Ala Thr Tyr Ser Arg Cys Gly Ser Gly Pro  
755 760 765

Trp Ile Thr Pro Arg Cys Met Val Asp Tyr Pro Tyr Arg Leu Trp His  
770 775 780



Tyr Pro Cys Thr Ile Asn Tyr Thr Ile Phe Lys Val Arg Met Tyr Val			
785	790	795	800
Gly Gly Val Glu His Arg Leu Glu Ala Ala Cys Asn Trp Thr Arg Gly			
	805	810	815
Glu Arg Cys Asp Leu Glu Asp Arg Asp Arg Ser Glu Leu Ser Pro Leu			
	820	825	830
Leu Leu Ser Thr Thr Gln Trp Gln Val Leu Pro Cys Ser Phe Thr Thr			
	835	840	845
Leu Pro Ala Leu Ser Thr Gly Leu Ile His Leu His Gln Asn Ile Val			
	850	855	860
Asp Val Gln Tyr Leu Tyr Gly Val Gly Ser Ser Ile Ala Ser Trp Ala			
	865	870	875
Ile Lys Trp Glu Tyr Val Val Leu Leu Phe Leu Leu Leu Ala Asp Ala			
	885	890	895
Arg Val Cys Ser Cys Leu Trp Met Met Leu Leu Ile Ser Gln Ala Glu			
	900	905	910
Ala Ile Gln Tyr Gly Ser Gly Glu Val Val Met Met Gly Asn Leu Leu			
	915	920	925
Thr His Asn Asn Ile Glu Val Val Thr Tyr Phe Leu Leu Leu Tyr Leu			
	930	935	940
Leu Leu Arg Glu Glu Ser Val Lys Lys Trp Val Leu Leu Leu Tyr His			
	945	950	955
Ile Leu Val Val His Pro Ile Lys Ser Val Ile Val Ile Leu Leu Met			
	965	970	975
Ile Gly Asp Val Val Lys Ala Asp Ser Gly Gly Gln Glu Tyr Leu Gly			
	980	985	990
Lys Ile Asp Leu Cys Phe Thr Thr Val Val Leu Ile Val Ile Gly Leu			
	995	1000	1005
Ile Ile Ala Arg Arg Asp Pro Thr Ile Val Pro Leu Val Thr Ile Met			
	1010	1015	1020
Ala Ala Leu Arg Val Thr Glu Leu Thr His Gln Pro Gly Val Asp Ile			
	1025	1030	1035
			1040

Ala Val Ala Val Met Thr Ile Thr Leu Leu Met Val Ser Tyr Val Thr			
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Asp Tyr Phe Arg Tyr Lys Lys Trp Leu Gln Cys Ile Leu Ser Leu Val			
1060	1065	1070	
Ser Gly Val Phe Leu Ile Arg Ser Leu Ile Tyr Leu Gly Arg Ile Glu			
1075	1080	1085	
Met Pro Glu Val Thr Ile Pro Asn Trp Arg Pro Leu Thr Leu Ile Leu			
1090	1095	1100	
Leu Tyr Leu Ile Ser Thr Thr Ile Val Thr Arg Trp Lys Val Asp Val			
1105	1110	1115	1120
Ala Gly Leu Leu Leu Gln Cys Val Pro Ile Leu Leu Leu Val Thr Thr			
1125	1130	1135	
Leu Trp Ala Asp Phe Leu Thr Leu Ile Leu Ile Leu Pro Thr Tyr Glu			
1140	1145	1150	
Leu Val Lys Leu Tyr Tyr Leu Lys Thr Val Arg Thr Asp Ile Glu Arg			
1155	1160	1165	
Ser Trp Leu Gly Gly Ile Asp Tyr Thr Arg Val Asp Ser Ile Tyr Asp			
1170	1175	1180	
Val Asp Glu Ser Gly Glu Gly Val Tyr Leu Phe Pro Ser Arg Gln Lys			
1185	1190	1195	1200
Ala Gln Gly Asn Phe Ser Ile Leu Leu Pro Leu Ile Lys Ala Thr Leu			
1205	1210	1215	
Ile Ser Cys Val Ser Ser Lys Trp Gln Leu Ile Tyr Met Ser Tyr Leu			
1220	1225	1230	
Thr Leu Asp Phe Met Tyr Tyr Met His Arg Lys Val Ile Glu Glu Ile			
1235	1240	1245	
Ser Gly Gly Thr Asn Ile Ile Ser Arg Leu Val Ala Ala Leu Ile Glu			
1250	1255	1260	
Leu Asn Trp Ser Met Glu Glu Glu Glu Ser Lys Gly Leu Lys Lys Phe			
1265	1270	1275	1280
Tyr Leu Leu Ser Gly Arg Leu Arg Asn Leu Ile Ile Lys His Lys Val			
1285	1290	1295	

Arg Asn Glu Thr Val Ala Ser Trp Tyr Gly Glu Glu Glu Val Tyr Gly  
 1300 1305 1310

Met Pro Lys Ile Met Thr Ile Ile Lys Ala Ser Thr Leu Ser Lys Ser  
 1315 1320 1325

Arg His Cys Ile Ile Cys Thr Val Cys Glu Gly Arg Glu Trp Lys Gly  
 1330 1335 1340

Gly Thr Cys Pro Lys Cys Gly Arg His Gly Lys Pro Ile Thr Cys Gly  
 1345 1350 1355 1360

Met Ser Leu Ala Asp Phe Glu Glu Arg His Tyr Lys Arg Ile Phe Ile  
 1365 1370 1375

Arg Glu Gly Asn Phe Glu Gly Met Cys Ser Arg Cys Gln Gly Lys His  
 1380 1385 1390

Arg Arg Phe Glu Met Asp Arg Glu Pro Lys Ser Ala Arg Tyr Cys Ala  
 1395 1400 1405

Glu Cys Asn Arg Leu His Pro Ala Glu Glu Gly Asp Phe Trp Ala Glu  
 1410 1415 1420

Ser Ser Met Leu Gly Leu Lys Ile Thr Tyr Phe Ala Leu Met Asp Gly  
 1425 1430 1435 1440

Lys Val Tyr Asp Ile Thr Glu Trp Ala Gly Cys Gln Arg Val Gly Ile  
 1445 1450 1455

Ser Pro Asp Thr His Arg Val Pro Cys His Ile Ser Phe Gly Ser Arg  
 1460 1465 1470

Met Pro Phe Arg Gln Glu Tyr Asn Gly Phe Val Gln Tyr Thr Ala Arg  
 1475 1480 1485

Gly Gln Leu Phe Leu Arg Asn Leu Pro Val Leu Ala Thr Lys Val Lys  
 1490 1495 1500

Met Leu Met Val Gly Asn Leu Gly Glu Glu Ile Gly Asn Leu Glu His  
 1505 1510 1515 1520

Leu Gly Trp Ile Leu Arg Gly Pro Ala Val Cys Lys Lys Ile Thr Glu  
 1525 1530 1535

His Glu Lys Cys His Ile Asn Ile Leu Asp Lys Leu Thr Ala Phe Phe  
 1540 1545 1550

Gly Ile Met Pro Arg Gly Thr Thr Pro Arg Ala Pro Val Arg Phe Pro		
1555	1560	1565
Thr Ser Leu Leu Lys Val Arg Arg Gly Leu Glu Thr Gly Trp Ala Tyr		
1570	1575	1580
Thr His Gln Gly Gly Ile Ser Ser Val Asp His Val Thr Ala Gly Lys		
1585	1590	1595 1600
Asp Leu Leu Val Cys Asp Ser Met Gly Arg Thr Arg Val Val Cys Gln		
1605	1610	1615
Ser Asn Asn Arg Leu Thr Asp Glu Thr Glu Tyr Gly Val Lys Thr Asp		
1620	1625	1630
Ser Gly Cys Pro Asp Gly Ala Arg Cys Tyr Val Leu Asn Pro Glu Ala		
1635	1640	1645
Val Asn Ile Ser Gly Ser Lys Gly Ala Val Val His Leu Gln Lys Thr		
1650	1655	1660
Gly Gly Glu Phe Thr Cys Val Thr Ala Ser Gly Thr Pro Ala Phe Phe		
1665	1670	1675 1680
Asp Leu Lys Asn Leu Lys Gly Trp Ser Gly Leu Pro Ile Phe Glu Ala		
1685	1690	1695
Ser Ser Gly Arg Val Val Gly Arg Val Lys Val Gly Lys Asn Glu Glu		
1700	1705	1710
Ser Lys Pro Thr Lys Ile Met Ser Gly Ile Gln Thr Val Ser Lys Asn		
1715	1720	1725
Thr Ala Asp Leu Thr Glu Met Val Lys Lys Ile Thr Ser Met Asn Arg		
1730	1735	1740
Gly Asp Phe Lys Gln Ile Thr Leu Ala Thr Gly Ala Gly Lys Thr Thr		
1745	1750	1755 1760
Glu Leu Pro Lys Ala Val Ile Glu Glu Ile Gly Arg His Lys Arg Val		
1765	1770	1775
Leu Val Leu Ile Pro Leu Arg Ala Ala Ala Glu Ser Val Tyr Gln Tyr		
1780	1785	1790
Met Arg Leu Lys His Pro Ser Ile Ser Phe Asn Leu Arg Ile Gly Asp		
1795	1800	1805

Met Lys Glu Gly Asp Met Ala Thr Gly Ile Thr Tyr Ala Ser Tyr Gly  
 1810 1815 1820

Tyr Phe Cys Gln Met Pro Gln Pro Lys Leu Arg Ala Ala Met Val Glu  
 1825 1830 1835 1840

Tyr Ser Tyr Ile Phe Leu Asp Glu Tyr His Cys Ala Thr Pro Glu Gln  
 1845 1850 1855

Leu Ala Ile Ile Gly Lys Ile His Arg Phe Ser Glu Ser Ile Arg Val  
 1860 1865 1870

Val Ala Met Thr Ala Thr Pro Ala Gly Ser Val Thr Thr Thr Gly Gln  
 1875 1880 1885

Lys His Pro Ile Glu Glu Phe Ile Ala Pro Glu Val Met Lys Gly Glu  
 1890 1895 1900

Asp Leu Gly Ser Gln Phe Leu Asp Ile Ala Gly Leu Lys Ile Pro Val  
 1905 1910 1915 1920

Asp Glu Met Lys Gly Asn Met Leu Val Phe Val Pro Thr Arg Asn Met  
 1925 1930 1935

Ala Val Glu Val Ala Lys Lys Leu Lys Ala Lys Gly Tyr Asn Ser Gly  
 1940 1945 1950

Tyr Tyr Tyr Ser Gly Glu Asp Pro Ala Asn Leu Arg Val Val Thr Ser  
 1955 1960 1965

Gln Ser Pro Tyr Val Ile Val Ala Thr Asn Ala Ile Glu Ser Gly Val  
 1970 1975 1980

Thr Leu Pro Asp Leu Asp Thr Val Ile Asp Thr Gly Leu Lys Cys Glu  
 1985 1990 1995 2000

Lys Arg Val Arg Val Ser Ser Lys Ile Pro Phe Ile Val Thr Gly Leu  
 2005 2010 2015

Lys Arg Met Ala Val Thr Val Gly Glu Gln Ala Gln Arg Arg Gly Arg  
 2020 2025 2030

Val Gly Arg Val Lys Pro Gly Arg Tyr Tyr Arg Ser Gln Glu Thr Ala  
 2035 2040 2045

Thr Gly Ser Lys Asp Tyr His Tyr Asp Leu Leu Gln Ala Gln Arg Tyr  
 2050 2055 2060

Gly Ile Glu Asp Gly Ile Asn Val Thr Lys Ser Phe Arg Glu Met Asn			
2065	2070	2075	2080
Tyr Asp Trp Ser Leu Tyr Glu Glu Asp Ser Leu Leu Ile Thr Gln Leu			
2085	2090	2095	
Glu Ile Leu Asn Asn Leu Leu Ile Ser Glu Asp Leu Pro Ala Ala Val			
2100	2105	2110	
Lys Asn Ile Met Ala Arg Thr Asp His Pro Glu Pro Ile Gln Leu Ala			
2115	2120	2125	
Tyr Asn Ser Tyr Glu Val Gln Val Pro Val Leu Phe Pro Lys Ile Arg			
2130	2135	2140	
Asn Gly Glu Val Thr Asp Thr Tyr Glu Asn Tyr Ser Phe Leu Asn Ala			
2145	2150	2155	2160
Arg Lys Leu Gly Glu Asp Val Pro Val Tyr Ile Tyr Ala Thr Glu Asp			
2165	2170	2175	
Glu Asp Leu Ala Val Asp Leu Leu Gly Leu Asp Trp Pro Asp Pro Gly			
2180	2185	2190	
Asn Gln Gln Val Val Glu Thr Gly Lys Ala Leu Lys Gln Val Thr Gly			
2195	2200	2205	
Leu Ser Ser Ala Glu Asn Ala Leu Leu Val Ala Leu Phe Gly Tyr Val			
2210	2215	2220	
Gly Tyr Gln Ala Leu Ser Lys Arg His Val Pro Met Ile Thr Asp Ile			
2225	2230	2235	2240
Tyr Thr Ile Glu Asp Gln Arg Leu Glu Asp Thr Thr His Leu Gln Tyr			
2245	2250	2255	
Ala Pro Asn Ala Ile Lys Thr Asp Gly Thr Glu Thr Glu Leu Lys Glu			
2260	2265	2270	
Leu Ala Ser Gly Asp Val Glu Lys Ile Met Gly Ala Ile Ser Asp Tyr			
2275	2280	2285	
Ala Ala Gly Gly Leu Glu Phe Val Lys Ser Gln Ala Glu Lys Ile Lys			
2290	2295	2300	
Thr Ala Pro Leu Phe Lys Glu Asn Ala Glu Ala Ala Lys Gly Tyr Val			
2305	2310	2315	2320

Gln Lys Phe Ile Asp Ser Leu Ile Glu Asn Lys Glu Glu Ile Ile Arg			
2325	2330	2335	
Tyr Gly Leu Trp Gly Thr His Thr Ala Leu Tyr Lys Ser Ile Ala Ala			
2340	2345	2350	
Arg Leu Gly His Glu Thr Ala Phe Ala Thr Leu Val Leu Lys Trp Leu			
2355	2360	2365	
Ala Phe Gly Gly Glu Ser Val Ser Asp His Val Lys Gln Ala Ala Val			
2370	2375	2380	
Asp Leu Val Val Tyr Tyr Val Met Asn Lys Pro Ser Phe Pro Gly Asp			
2385	2390	2395	2400
Ser Glu Thr Gln Gln Glu Gly Arg Arg Phe Val Ala Ser Leu Phe Ile			
2405	2410	2415	
Ser Ala Leu Ala Thr Tyr Thr Tyr Lys Thr Trp Asn Tyr His Asn Leu			
2420	2425	2430	
Ser Lys Val Val Glu Pro Ala Leu Ala Tyr Leu Pro Tyr Ala Thr Ser			
2435	2440	2445	
Ala Leu Lys Met Phe Thr Pro Thr Arg Leu Glu Ser Val Val Ile Leu			
2450	2455	2460	
Ser Thr Thr Ile Tyr Lys Thr Tyr Leu Ser Ile Arg Lys Gly Lys Ser			
2465	2470	2475	2480
Asp Gly Leu Leu Gly Thr Gly Ile Ser Ala Ala Met Glu Ile Leu Ser			
2485	2490	2495	
Gln Asn Pro Val Ser Val Gly Ile Ser Val Met Leu Gly Val Gly Ala			
2500	2505	2510	
Ile Ala Ala His Asn Ala Ile Glu Ser Ser Glu Gln Lys Arg Thr Leu			
2515	2520	2525	
Leu Met Lys Val Phe Val Lys Asn Phe Leu Asp Gln Ala Ala Thr Asp			
2530	2535	2540	
Glu Leu Val Lys Glu Asn Pro Glu Lys Ile Ile Met Ala Leu Phe Glu			
2545	2550	2555	2560
Ala Val Gln Thr Ile Gly Asn Pro Leu Arg Leu Ile Tyr His Leu Tyr			
2565	2570	2575	

Gly Val Tyr Tyr Lys Gly Trp Glu Ala Lys Glu Leu Ser Glu Arg Thr  
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Ala Gly Arg Asn Leu Phe Thr Leu Ile Met Phe Glu Ala Phe Glu Leu  
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Leu Gly Met Asp Ser Gln Gly Lys Ile Arg Asn Leu Ser Gly Asn Tyr  
 2610 2615 2620

Ile Leu Asp Leu Ile Tyr Gly Leu His Lys Gln Ile Asn Arg Gly Leu  
 2625 2630 2635 2640

Lys Lys Met Val Leu Gly Trp Ala Pro Ala Pro Phe Ser Cys Asp Trp  
 2645 2650 2655

Thr Pro Ser Asp Glu Arg Ile Arg Leu Pro Thr Asp Asn Tyr Leu Arg  
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Val Glu Thr Arg Cys Pro Cys Gly Tyr Glu Met Lys Ala Phe Lys Asn  
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Val Gly Gly Lys Leu Thr Lys Val Glu Glu Ser Gly Pro Phe Leu Cys  
 2690 2695 2700

Arg Asn Arg Pro Gly Arg Gly Pro Val Asn Tyr Arg Val Thr Lys Tyr  
 2705 2710 2715 2720

Tyr Asp Asp Asn Leu Arg Glu Ile Lys Pro Val Ala Lys Leu Glu Gly  
 2725 2730 2735

Gln Val Glu His Tyr Tyr Lys Gly Val Thr Ala Lys Ile Asp Tyr Ser  
 2740 2745 2750

Lys Gly Lys Met Leu Leu Ala Thr Asp Lys Trp Glu Val Glu His Gly  
 2755 2760 2765

Val Ile Thr Arg Leu Ala Lys Arg Tyr Thr Gly Val Gly Phe Asn Gly  
 2770 2775 2780

Ala Tyr Leu Gly Asp Glu Pro Asn His Arg Ala Leu Val Glu Arg Asp  
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Cys Ala Thr Ile Thr Lys Asn Thr Val Gln Phe Leu Lys Met Lys Lys  
 2805 2810 2815

Gly Cys Ala Phe Thr Tyr Asp Leu Thr Ile Ser Asn Leu Thr Arg Leu  
 2820 2825 2830



Ile Glu Leu Val His Arg Asn Asn Leu Glu Glu Lys Glu Ile Pro Thr  
 2835 2840 2845

Ala Thr Val Thr Thr Trp Leu Ala Tyr Thr Phe Val Asn Glu Asp Val  
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Gly Thr Ile Lys Pro Val Leu Gly Glu Arg Val Ile Pro Asp Pro Val  
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Val Asp Ile Asn Leu Gln Pro Glu Val Gln Val Asp Thr Ser Glu Val  
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Pro Val Leu Glu Lys Val Glu Pro Asp Ala Ser Asp Asn Gln Asn Ser  
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Val Lys Ile Gly Leu Asp Glu Gly Asn Tyr Pro Gly Pro Gly Ile Gln  
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Thr His Thr Leu Thr Glu Glu Ile His Asn Arg Asp Ala Arg Pro Phe  
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Ile Met Ile Leu Gly Ser Arg Asn Ser Ile Ser Asn Arg Ala Lys Thr  
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Ala Arg Asn Ile Asn Leu Tyr Thr Gly Asn Asp Pro Arg Glu Ile Arg  
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Asp Leu Met Ala Ala Gly Arg Met Leu Val Val Ala Leu Arg Asp Val  
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Asp Pro Glu Leu Ser Glu Met Val Asp Phe Lys Gly Thr Phe Leu Asp  
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Arg Glu Ala Leu Glu Ala Leu Ser Leu Gly Gln Pro Lys Pro Lys Gln  
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Val Thr Lys Glu Ala Val Arg Asn Leu Ile Glu Gln Lys Lys Asp Val  
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Glu Ile Pro Asn Trp Phe Ala Ser Asp Asp Pro Val Phe Leu Glu Val  
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Ala Leu Lys Asn Asp Lys Tyr Tyr Leu Val Gly Asp Val Gly Glu Val  
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Lys Asp Gln Ala Lys Ala Leu Gly Ala Thr Asp Gln Thr Arg Ile Ile  
 3090 3095 3100

Lys Glu Val Gly Ser Arg Thr Tyr Ala Met Lys Leu Ser Ser Trp Phe  
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Leu Gln Ala Ser Asn Lys Gln Met Ser Leu Thr Pro Leu Phe Glu Glu  
 3125 3130 3135

Leu Leu Leu Arg Cys Pro Pro Ala Thr Lys Ser Asn Lys Gly His Met  
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Ala Ser Ala Tyr Gln Leu Ala Gln Gly Asn Trp Glu Pro Leu Gly Cys  
 3155 3160 3165

Gly Val His Leu Gly Thr Ile Pro Ala Arg Arg Val Lys Ile His Pro  
 3170 3175 3180

Tyr Glu Ala Tyr Leu Lys Leu Lys Asp Phe Ile Glu Glu Glu Glu Lys  
 3185 3190 3195 3200

Lys Pro Arg Val Lys Asp Thr Val Ile Arg Glu His Asn Lys Trp Ile  
 3205 3210 3215

Leu Lys Lys Ile Arg Phe Gln Gly Asn Leu Asn Thr Lys Lys Met Leu  
 3220 3225 3230

Asn Pro Gly Lys Leu Ser Glu Gln Leu Asp Arg Glu Gly Arg Lys Arg  
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Asn Ile Tyr Asn His Gln Ile Gly Thr Ile Met Ser Ser Ala Gly Ile  
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Arg Leu Glu Lys Leu Pro Ile Val Arg Ala Gln Thr Asp Thr Lys Thr  
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Phe His Glu Ala Ile Arg Asp Lys Ile Asp Lys Ser Glu Asn Arg Gln  
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Asn Pro Glu Leu His Asn Lys Leu Leu Glu Ile Phe His Thr Ile Ala  
 3300 3305 3310

Gln Pro Thr Leu Lys His Thr Tyr Gly Glu Val Thr Trp Glu Gln Leu  
 3315 3320 3325

Glu Ala Gly Ile Asn Arg Lys Gly Ala Ala Gly Phe Leu Glu Lys Lys  
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Asn Ile Gly Glu Val Leu Asp Ser Glu Lys His Leu Val Glu Gln Leu  
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Val Arg Asp Leu Lys Ala Gly Arg Lys Ile Lys Tyr Tyr Glu Thr Ala  
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Ile Pro Lys Asn Glu Lys Arg Asp Val Ser Asp Asp Trp Gln Ala Gly  
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Asp Leu Val Val Glu Lys Arg Pro Arg Val Ile Gln Tyr Pro Glu Ala  
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Lys Thr Arg Leu Ala Ile Thr Lys Val Met Tyr Asn Trp Val Lys Gln  
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Gln Pro Val Val Ile Pro Gly Tyr Glu Gly Lys Thr Pro Leu Phe Asn  
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Ile Phe Asp Lys Val Arg Lys Glu Trp Asp Ser Phe Asn Glu Pro Val  
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Ala Val Ser Phe Asp Thr Lys Ala Trp Asp Thr Gln Val Thr Ser Lys  
                     3460                      3465                      3470

Asp Leu Gln Leu Ile Gly Glu Ile Gln Lys Tyr Tyr Tyr Lys Lys Glu  
                     3475                      3480                      3485

Trp His Lys Phe Ile Asp Thr Ile Thr Asp His Met Thr Glu Val Pro  
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Val Ile Thr Ala Asp Gly Glu Val Tyr Ile Arg Asn Gly Gln Arg Gly  
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Ser Gly Gln Pro Asp Thr Ser Ala Gly Asn Ser Met Leu Asn Val Leu  
                     3525                      3530                      3535

Thr Met Met Tyr Ala Phe Cys Glu Ser Thr Gly Val Pro Tyr Lys Ser  
                     3540                      3545                      3550

Phe Asn Arg Val Ala Arg Ile His Val Cys Gly Asp Asp Gly Phe Leu  
                     3555                      3560                      3565

Ile Thr Glu Lys Gly Leu Gly Leu Lys Phe Ala Asn Lys Gly Met Gln  
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Ile Leu His Glu Ala Gly Lys Pro Gln Lys Ile Thr Glu Gly Glu Lys  
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Met Lys Val Ala Tyr Arg Phe Glu Asp Ile Glu Phe Cys Ser His Thr  
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Pro Val Pro Val Arg Trp Ser Asp Asn Thr Ser Ser His Met Ala Gly  
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Arg Asp Thr Ala Val Ile Leu Ser Lys Met Ala Thr Arg Leu Asp Ser  
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Ser Gly Glu Arg Gly Thr Thr Ala Tyr Glu Lys Ala Val Ala Phe Ser  
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Phe Leu Leu Met Tyr Ser Trp Asn Pro Leu Val Arg Arg Ile Cys Leu  
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Leu Val Leu Ser Gln Gln Pro Glu Thr Asp Pro Ser Lys His Ala Thr  
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Tyr Tyr Tyr Lys Gly Asp Pro Ile Gly Ala Tyr Lys Asp Val Ile Gly  
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Arg Asn Leu Ser Glu Leu Lys Arg Thr Gly Phe Glu Lys Leu Ala Asn  
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Lys Arg Ile Ile Gln Asp Cys Val Ala Ile Gly Lys Glu Glu Gly Asn  
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Tyr Ile Pro Asp Lys Gly Phe Thr Leu Gln Gly Lys His Tyr Glu Gln  
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Leu Gln Leu Arg Thr Glu Thr Asn Pro Val Met Gly Val Gly Thr Glu  
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Ile Leu Leu Met Thr Ala Val Gly Val Ser Ser  
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caagactgct agccgagtag cgttggggtg cgaaaggcct tgtggtagtg cctgataggg 300
tgcttgcgag tgccccggga ggtctcgtag accgtgcacc atgagcacia atcctaaacc 360
tcaaaagaaa accaaaagaa acaccaaccg tcgcccacaa gacgttaagt ttccggggcg 420
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<400> 4

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			20						25				30		

Gly	Val	Tyr	Leu	Leu	Pro	Arg	Arg	Gly	Pro	Arg	Leu	Gly	Val	Arg	Ala
		35						40					45		

Thr	Arg	Lys	Thr	Ser	Glu	Arg	Ser	Gln	Pro	Arg	Gly	Arg	Arg	Gln	Pro
		50					55					60			

Ile	Pro	Lys	Asp	Arg	Arg	Ser	Thr	Gly	Lys	Ser	Trp	Gly	Lys	Pro	Gly
	65					70				75				80	

Tyr	Pro	Trp	Pro	Leu	Tyr	Gly	Asn	Glu	Gly	Leu	Gly	Trp	Ala	Gly	Trp
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Leu Leu Ser Pro Arg Gly Ser Arg Pro Ser Trp Gly Pro Asn Asp Pro  
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Arg His Arg Ser Arg Asn Val Gly Lys Val Ile Asp Thr Leu Thr Cys  
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Gly Gly Val Ala Arg Ala Leu Ala His Gly Val Arg Val Leu Glu Asp  
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Phe Leu Leu Ala Leu Leu Ser Cys Ile Thr Thr Pro Val Ser Ala Ala  
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Glu Val Lys Asn Ile Ser Thr Gly Tyr Met Val Thr Asn Asp Cys Thr  
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Asn Asp Ser Ile Thr Trp Gln Leu Gln Ala Ala Val Leu His Val Pro  
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Gly Cys Val Pro Cys Glu Lys Val Gly Asn Ala Ser Gln Cys Trp Ile  
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Phe Thr Leu Thr Pro Gly Tyr Lys Thr Leu Leu Ser Arg Phe Leu Trp  
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Pro Val Glu Thr Leu Asp Ile Val Thr Arg Ser Pro Thr Phe Ser Asp	1205	1210	1215
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Ala Ala Gln Gly Tyr Lys Val Leu Val Leu Asn Pro Ser Val Ala Ala	1250	1255	1260
Thr Leu Gly Phe Gly Ala Tyr Leu Ser Lys Ala His Gly Ile Asn Pro	1265	1270	1275
Asn Ile Arg Thr Gly Val Arg Thr Val Thr Thr Gly Ala Pro Ile Thr	1285	1290	1295
Tyr Ser Thr Tyr Gly Lys Phe Leu Ala Asp Gly Gly Cys Ala Gly Gly	1300	1305	1310
Ala Tyr Asp Ile Ile Ile Cys Asp Glu Cys His Ala Val Asp Ser Thr	1315	1320	1325
Thr Ile Leu Gly Ile Gly Thr Val Leu Asp Gln Ala Glu Thr Ala Gly	1330	1335	1340
Val Arg Leu Thr Val Leu Ala Thr Ala Thr Pro Pro Gly Ser Val Thr	1345	1350	1355
Thr Pro His Pro Asn Ile Glu Glu Val Ala Leu Gly Gln Glu Gly Glu	1365	1370	1375

Ile Pro Phe Tyr Gly Arg Ala Ile Pro Leu Ser Tyr Ile Lys Gly Gly  
1380 1385 1390

Arg His Leu Ile Phe Cys His Ser Lys Lys Lys Cys Asp Glu Leu Ala  
1395 1400 1405

Ala Ala Leu Arg Gly Met Gly Leu Asn Ser Val Ala Tyr Tyr Arg Gly  
1410 1415 1420

Leu Asp Val Ser Val Ile Pro Thr Gln Gly Asp Val Val Val Val Ala  
1425 1430 1435 1440

Thr Asp Ala Leu Met Thr Gly Tyr Thr Gly Asp Phe Asp Ser Val Ile  
1445 1450 1455

Asp Cys Asn Val Ala Val Thr Gln Val Val Asp Phe Ser Leu Asp Pro  
1460 1465 1470

Thr Phe Thr Ile Thr Thr Gln Ile Val Pro Gln Asp Ala Val Ser Arg  
1475 1480 1485

Ser Gln Arg Arg Gly Arg Thr Gly Arg Gly Arg Leu Gly Ile Tyr Arg  
1490 1495 1500

Tyr Val Ser Thr Gly Glu Arg Ala Ser Gly Met Phe Asp Ser Val Val  
1505 1510 1515 1520

Leu Cys Glu Cys Tyr Asp Ala Gly Ala Ala Trp Tyr Glu Leu Thr Pro  
1525 1530 1535

Ser Glu Thr Thr Val Arg Leu Arg Ala Tyr Phe Asn Thr Pro Gly Leu  
1540 1545 1550

Pro Val Cys Gln Asp His Leu Glu Phe Trp Glu Ala Val Phe Thr Gly  
1555 1560 1565

Leu Thr His Ile Asp Ala His Phe Leu Ser Gln Thr Lys Gln Ser Gly  
1570 1575 1580

Glu Asn Phe Ala Tyr Leu Thr Ala Tyr Gln Ala Thr Val Cys Ala Arg  
1585 1590 1595 1600

Ala Lys Ala Pro Pro Pro Ser Trp Asp Val Met Trp Lys Cys Leu Thr  
1605 1610 1615

Arg Leu Lys Pro Thr Leu Val Gly Pro Thr Pro Leu Leu Tyr Arg Leu  
1620 1625 1630

Gly Ser Val Thr Asn Glu Val Thr Leu Thr His Pro Val Thr Lys Tyr  
 1635 1640 1645

Ile Ala Thr Cys Met Gln Ala Asp Leu Glu Val Met Thr Ser Thr Trp  
 1650 1655 1660

Val Leu Ala Gly Gly Val Leu Ala Ala Val Ala Ala Tyr Cys Leu Ala  
 1665 1670 1675 1680

Thr Gly Cys Val Cys Ile Ile Gly Arg Leu His Ile Asn Gln Arg Ala  
 1685 1690 1695

Val Val Ala Pro Asp Lys Glu Val Leu Tyr Glu Ala Phe Asp Glu Met  
 1700 1705 1710

Glu Glu Cys Ala Ser Arg Ala Ala Leu Ile Glu Glu Gly Gln Arg Ile  
 1715 1720 1725

Ala Glu Met Leu Lys Ser Lys Ile Gln Gly Leu Leu Gln Gln Ala Ser  
 1730 1735 1740

Lys Gln Ala Gln Asp Ile Gln Pro Thr Val Gln Ala Ser Trp Pro Lys  
 1745 1750 1755 1760

Val Glu Gln Phe Trp Ala Lys His Met Trp Asn Phe Ile Ser Gly Ile  
 1765 1770 1775

Gln Tyr Leu Ala Gly Leu Ser Thr Leu Pro Gly Asn Pro Ala Val Ala  
 1780 1785 1790

Ser Met Met Ala Phe Ser Ala Ala Leu Thr Ser Pro Leu Ser Thr Ser  
 1795 1800 1805

Thr Thr Ile Leu Leu Asn Ile Leu Gly Gly Trp Leu Ala Ser Gln Ile  
 1810 1815 1820

Ala Pro Pro Ala Gly Ala Thr Gly Phe Val Val Ser Gly Leu Val Gly  
 1825 1830 1835 1840

Ala Ala Val Gly Ser Ile Gly Leu Gly Lys Val Leu Val Asp Ile Leu  
 1845 1850 1855

Ala Gly Tyr Gly Ala Gly Ile Ser Gly Ala Leu Val Ala Phe Lys Ile  
 1860 1865 1870

Met Ser Gly Glu Lys Pro Ser Met Glu Asp Val Val Asn Leu Leu Pro  
 1875 1880 1885

Gly Ile Leu Ser Pro Gly Ala Leu Val Val Gly Val Ile Cys Ala Ala			
1890	1895	1900	
Ile Leu Arg Arg His Val Gly Pro Gly Glu Gly Ala Val Gln Trp Met			
1905	1910	1915	1920
Asn Arg Leu Ile Ala Phe Ala Ser Arg Gly Asn His Val Ala Pro Thr			
1925	1930	1935	
His Tyr Val Thr Glu Ser Asp Ala Ser Gln Arg Val Thr Gln Leu Leu			
1940	1945	1950	
Gly Ser Leu Thr Ile Thr Ser Leu Leu Arg Arg Leu His Asn Trp Ile			
1955	1960	1965	
Thr Glu Asp Cys Pro Ile Pro Cys Gly Gly Ser Trp Leu Arg Asp Val			
1970	1975	1980	
Trp Asp Trp Val Cys Thr Ile Leu Thr Asp Phe Lys Asn Trp Leu Thr			
1985	1990	1995	2000
Ser Lys Leu Phe Pro Lys Met Pro Gly Leu Pro Phe Val Ser Cys Gln			
2005	2010	2015	
Lys Gly Tyr Lys Gly Val Trp Ala Gly Thr Gly Ile Met Thr Thr Arg			
2020	2025	2030	
Cys Pro Cys Gly Ala Asn Ile Ser Gly Asn Val Arg Leu Gly Ser Met			
2035	2040	2045	
Arg Ile Thr Gly Pro Lys Thr Cys Met Asn Ile Trp Gln Gly Thr Phe			
2050	2055	2060	
Pro Ile Asn Cys Tyr Thr Glu Gly Gln Cys Val Pro Lys Pro Ala Pro			
2065	2070	2075	2080
Asn Phe Lys Val Ala Ile Trp Arg Val Ala Ala Ser Glu Tyr Ala Glu			
2085	2090	2095	
Val Thr Gln His Gly Ser Tyr His Tyr Ile Thr Gly Leu Thr Thr Asp			
2100	2105	2110	
Asn Leu Lys Val Pro Cys Gln Leu Pro Ser Pro Glu Phe Phe Ser Trp			
2115	2120	2125	
Val Asp Gly Val Gln Ile His Arg Phe Ala Pro Thr Pro Lys Pro Phe			
2130	2135	2140	



Phe Arg Asp Glu Val Ser Phe Cys Val Gly Leu Asn Ser Phe Val Val  
2145 2150 2155 2160

Gly Ser Gln Leu Pro Cys Asp Pro Glu Pro Asp Thr Asp Val Leu Met  
2165 2170 2175

Ser Met Leu Thr Asp Pro Ser His Ile Thr Ala Glu Thr Ala Ala Arg  
2180 2185 2190

Arg Leu Ala Arg Gly Ser Pro Pro Ser Glu Ala Ser Ser Ala Ser  
2195 2200 2205

Gln Leu Ser Ala Pro Ser Leu Arg Ala Thr Cys Thr Thr His Gly Lys  
2210 2215 2220

Ala Tyr Asp Val Asp Met Val Asp Ala Asn Leu Phe Met Gly Gly Asp  
2225 2230 2235 2240

Val Thr Arg Ile Glu Ser Gly Ser Lys Val Val Val Leu Asp Ser Leu  
2245 2250 2255

Asp Pro Met Val Glu Glu Arg Ser Asp Leu Glu Pro Ser Ile Pro Ser  
2260 2265 2270

Glu Tyr Met Leu Pro Lys Lys Arg Phe Pro Pro Ala Leu Pro Ala Trp  
2275 2280 2285

Ala Arg Pro Asp Tyr Asn Pro Pro Leu Val Glu Ser Trp Lys Arg Pro  
2290 2295 2300

Asp Tyr Gln Pro Ala Thr Val Ala Gly Cys Ala Leu Pro Pro Pro Arg  
2305 2310 2315 2320

Lys Thr Pro Thr Pro Pro Pro Arg Arg Arg Arg Thr Val Gly Leu Ser  
2325 2330 2335

Glu Asp Ser Ile Gly Asp Ala Leu Gln Gln Leu Ala Ile Lys Ser Phe  
2340 2345 2350

Gly Gln Pro Pro Pro Ser Gly Asp Ser Gly Leu Ser Thr Gly Ala Gly  
2355 2360 2365

Ala Ala Asp Ser Gly Ser Gln Thr Pro Pro Asp Glu Leu Ala Leu Ser  
2370 2375 2380

Glu Thr Gly Ser Ile Ser Ser Met Pro Pro Leu Glu Gly Glu Leu Gly  
2385 2390 2395 2400

Asp Pro Asp Leu Glu Pro Glu Gln Val Glu Pro Gln Pro Pro Pro Gln  
 2405 2410 2415

Gly Gly Val Ala Ala Pro Gly Ser Asp Ser Gly Ser Trp Ser Thr Cys  
 2420 2425 2430

Ser Glu Glu Asp Asp Ser Val Val Cys Cys Ser Met Ser Tyr Ser Trp  
 2435 2440 2445

Thr Gly Ala Leu Ile Thr Pro Cys Ser Pro Glu Glu Glu Lys Leu Pro  
 2450 2455 2460

Ile Asn Pro Leu Ser Asn Ser Leu Leu Arg Tyr His Asn Lys Val Tyr  
 2465 2470 2475 2480

Cys Thr Thr Thr Lys Ser Ala Ser Leu Arg Ala Lys Lys Val Thr Phe  
 2485 2490 2495

Asp Arg Met Gln Val Leu Asp Ser Tyr Tyr Asp Ser Val Leu Lys Asp  
 2500 2505 2510

Ile Lys Leu Ala Ala Ser Lys Val Thr Ala Arg Leu Leu Thr Met Glu  
 2515 2520 2525

Glu Ala Cys Gln Leu Thr Pro Pro His Ser Ala Arg Ser Lys Tyr Gly  
 2530 2535 2540

Phe Gly Ala Lys Glu Val Arg Ser Leu Ser Gly Arg Ala Val Asn His  
 2545 2550 2555 2560

Ile Lys Ser Val Trp Lys Asp Leu Leu Glu Asp Ser Glu Thr Pro Ile  
 2565 2570 2575

Pro Thr Thr Ile Met Ala Lys Asn Glu Val Phe Cys Val Asp Pro Thr  
 2580 2585 2590

Lys Gly Gly Lys Lys Ala Ala Arg Leu Ile Val Tyr Pro Asp Leu Gly  
 2595 2600 2605

Val Arg Val Cys Glu Lys Met Ala Leu Tyr Asp Ile Thr Gln Lys Leu  
 2610 2615 2620

Pro Gln Ala Val Met Gly Ala Ser Tyr Gly Phe Gln Tyr Ser Pro Ala  
 2625 2630 2635 2640

Gln Arg Val Glu Phe Leu Leu Lys Ala Trp Ala Glu Lys Lys Asp Pro  
 2645 2650 2655

Met Gly Phe Ser Tyr Asp Thr Arg Cys Phe Asp Ser Thr Val Thr Glu			
2660	2665	2670	
Arg Asp Ile Arg Thr Glu Glu Ser Ile Tyr Arg Ala Cys Ser Leu Pro			
2675	2680	2685	
Glu Glu Ala His Thr Ala Ile His Ser Leu Thr Glu Arg Leu Tyr Val			
2690	2695	2700	
Gly Gly Pro Met Phe Asn Ser Lys Gly Gln Thr Cys Gly Tyr Arg Arg			
2705	2710	2715	2720
Cys Arg Ala Ser Gly Val Leu Thr Thr Ser Met Gly Asn Thr Ile Thr			
2725	2730	2735	
Cys Tyr Val Lys Ala Leu Ala Ala Cys Lys Ala Ala Gly Ile Ile Ala			
2740	2745	2750	
Pro Thr Met Leu Val Cys Gly Asp Asp Leu Val Val Ile Ser Glu Ser			
2755	2760	2765	
Gln Gly Thr Glu Glu Asp Glu Arg Asn Leu Arg Ala Phe Thr Glu Ala			
2770	2775	2780	
Met Thr Arg Tyr Ser Ala Pro Pro Gly Asp Pro Pro Arg Pro Glu Tyr			
2785	2790	2795	2800
Asp Leu Glu Leu Ile Thr Ser Cys Ser Ser Asn Val Ser Val Ala Leu			
2805	2810	2815	
Gly Pro Gln Gly Arg Arg Arg Tyr Tyr Leu Thr Arg Asp Pro Thr Thr			
2820	2825	2830	
Pro Ile Ala Arg Ala Ala Trp Glu Thr Val Arg His Ser Pro Val Asn			
2835	2840	2845	
Ser Trp Leu Gly Asn Ile Ile Gln Tyr Ala Pro Thr Ile Trp Ala Arg			
2850	2855	2860	
Met Val Leu Met Thr His Phe Phe Ser Ile Leu Met Ala Gln Asp Thr			
2865	2870	2875	2880
Leu Asp Gln Asn Leu Asn Phe Glu Met Tyr Gly Ala Val Tyr Ser Val			
2885	2890	2895	
Ser Pro Leu Asp Leu Pro Ala Ile Ile Glu Arg Leu His Gly Leu Asp			
2900	2905	2910	

Ala Phe Ser Leu His Thr Tyr Thr Pro His Glu Leu Thr Arg Val Ala

2915

2920

2925

Ser Ala Leu Arg Lys Leu Gly Ala Pro Pro Leu Arg Ala Trp Lys Ser

2930

2935

2940

Arg Ala Arg Ala Val Arg Ala Ser Leu Ile Ser Arg Gly Gly Arg Ala

2945

2950

2955

2960

Ala Val Cys Gly Arg Tyr Leu Phe Asn Trp Ala Val Lys Thr Lys Leu

2965

2970

2975

Lys Leu Thr Pro Leu Pro Glu Ala Arg Leu Leu Asp Leu Ser Ser Trp

2980

2985

2990

Phe Thr Val Gly Ala Gly Gly Gly Asp Ile Tyr His Ser Val Ser Arg

2995

3000

3005

Ala Arg Pro Arg Leu Leu Leu Phe Gly Leu Leu Leu Leu Phe Val Gly

3010

3015

3020

Val Gly Leu Phe Leu Leu Pro Ala Arg

3025

3030